UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2004/00650

July 12, 2004

Mr. Denis Williamson
District Manager
Salem District
Bureau of Land Management
1717 Fabry Road SE
Salem, Oregon 97306

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation on Control of Knotweed on Selected Non-Federal Lands, Willamette River Basin, 2004 through 2007, Benton, Lane, Linn, Marion, Polk, and Yamhill Counties, Oregon

Dear Mr. Williamson:

Enclosed is a biological opinion (Opinion) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of the Bureau of Land Management (BLM), Willamette National Forest (WNF), and Cascade Pacific Resource Conservation and Development, Inc. (CPRCD) proposed project to control knotweed using the herbicide glyphosate (Rodeo®, AquaMaster®, or similar formulation) on selected non-federal lands in the Willamette River basin. The Salem District BLM prepared and submitted the biological assessment (BA) for this project, and is designated the lead agency for this consultation. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of listed Upper Willamette River (UWR) steelhead (*Oncorhynchus mykiss*) or UWR Chinook salmon (*O. tshawytscha*). As required by section 7 of the ESA, NOAA Fisheries has included reasonable and prudent measures with nondiscretionary terms and conditions that NOAA Fisheries believes are necessary to minimize incidental take associated with this action.

This document also serves as consultation on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and includes conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects to EFH. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NOAA Fisheries within 30 days after receiving these recommendations. If the response is inconsistent with the recommendations, the action agency must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations.

If you have questions regarding this consultation, please contact Ron Lindland of my staff in the Willamette Basin Habitat Branch of the Oregon State Habitat Office at 503.230.2315.

Sincerely,

for Michael R Crouse

D. Robert Lohn
Regional Administrator

cc: Bob Ruediger, BLM
Brad Goehring, USFWS

Endangered Species Act - Section 7 Consultation
Biological Opinion

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Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Control of Knotweed on Selected Non-Federal Lands,
Willamette River Basin, 2004 through 2007,
Benton, Lane, Linn, Marion, Polk, and Yamhill Counties, Oregon

Agencies:	Salem District, Bureau of Land Management Willamette National Forest, U.S Forest Service
Consultation Conducted By:	NOAA's National Marine Fisheries Service, Northwest Region
Date Issued:	July 12, 2004
Issued by:	For Michael R Crouse ____________________ D. Robert Lohn Regional Administrator
Refer to:	**2004/00650**

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Parts per million

1 ppm = 1,000 ppb (parts per billion)
1 ppm = 1,000 mu g/L (micrograms per liter)
1 ppm = 1 mg/L (milligrams per liter)

1. INTRODUCTION

1.1 Consultation History

On June 7, 2004, NOAA's National Marine Fisheries Service (NOAA Fisheries) received a letter dated June 3, 2004, from the Salem District of the Bureau of Land Management (BLM) requesting formal consultation pursuant to section 7 of the Endangered Species Act (ESA) and consultation pursuant to section 305(b) of the Magnuson-Stevens Fishery Management and Conservation Act (MSA) for a proposed project to control knotweed (*Polygonum spp.*) on selected non-federal lands in the Willamette River basin using the herbicide glyphosate (Rodeo®, AquaMaster®, or similar formulation). A biological assessment (BA) dated May 27, 2004, accompanied the June 3, 2004 letter. Most of the known sites will be treated in 2004 or 2005. Follow-up treatments and treatment of newly-discovered sites could continue through 2007.

The BLM prepared the BA, and is the designated lead agency for consultation on this project. NOAA Fisheries staff provided technical assistance as part of the Willamette Province Level 1 ESA Consultation Streamlining Team (Level 1 Team) in accordance with the February 26, 1997 (revised June 1999), consultation streamlining guidelines (NOAA Fisheries *et al*. 1999). In the BA, the BLM used procedures established in NOAA Fisheries (1996) to determine the effects of the proposed action.

The BLM determined that the proposed project to control knotweed on selected non-federal lands in the Willamette River basin may effect and was "likely to adversely affect" (LAA) Upper Willamette River (UWR) steelhead (*Oncorhynchus mykiss*) and UWR Chinook salmon (*O. tshawytscha*). This proposed action is the subject of this biological opinion (Opinion). In addition, the BA provided an evaluation of the effects the proposed action would have on habitat designated as essential fish habitat (EFH) under the MSA.

1.2 Proposed Action

The proposed action is the funding by BLM and the Willamette National Forest (WNF) for the Cascade Pacific Resource Conservation and Development, Inc. (CPRCD) and subcontractors to complete a knotweed control project on selected non-federal lands along certain Willamette River tributary streams. Table 1 lists the watersheds where treatment will occur, the estimated acres to be treated each year, and estimated amount of glyphosate (Rodeo®, AquaMaster®, or similar formulation) used to perform the treatments each year.

Table 1. Estimated acres of knotweed to be treated and gallons of glyphosate concentrate to be used in each watershed each year.

5th Field Watershed	**6th Field Watershed(s)**	**Est. Total Acres**	**Estimated Acres Treated Each Year***				**Maximum Estimated Glyphosate Concentrate Used (Gallons)****			
			2004	***2005***	***2006***	***2007***	***2004***	***2005***	***2006***	***2007***
North Yamhill (1709000806)	Baker Creek and Berry Creek (170900080606)	6	4	3.2	1	0.3	14	11	4	2
Willamette River/Chehalem Creek (1709000703)	Glenn Creek (170900070302)	0.25	0.25	0.1	0	0	1	1	0	0
Rickreall Creek (1709000702)	Upper Rickreall Creek (170900070201)	3	2	1.6	0.5	0.1	7	6	2	2
Luckiamute River (1709000306)	Upper Luckiamute ((170900030602)	24	0	5	5	5	0	17	17	17
Abiqua Creek (1709000901)	Drift Creek (170900090106) Brush Creek (170900090105)	3	2	1.6	0.5	0.1	7	6	2	2
Thomas Creek (1709000607)	Neal Creek (170900060704)	5	2	2.6	1.6	0.3	7	9	6	2
Crabtree Creek (1709000606)	Roaring River (170900060602)	15	5	5	3	2	17	17	11	7
Hamilton Creek/South Santiam (1709000608)	Ames Creek (170900060801)	1	1	0.3	0.1	0	4	2	1	0
N.Fk. of Mdl.Fk. Will. (1709000106)/Salmon Creek (1709000104)/Hills Cr. Res. (1709000105)	Dartmouth Creek (170900010608) , Lower Salmon Creek (170900010403), and Gray Creek (170900010505)	1	1	0.3	0.1	0	4	2	1	0
	Total Acres or Gallons	58.25	17.25	19.7	11.8	7.8	61	71	44	32

* The sum of the acres treated by year may not be equal to the total acres treated in a watershed because some areas may need to be treated more than once.

** Estimated gallons of glyphosate concentrate used assumes 75% stem injection and 25% foliar spray application. No more than 2 gallons of concentrate will be applied in one treatment within 1 acre. Gallons have been rounded up to the next whole gallon.

CPRCD will coordinate the project and subcontract with Soil and Water Conservation Districts (SWCD), watershed councils, and the Oregon Department of Agriculture (ODA). The purpose of the project is to control or eradicate three species of knotweed: Japanese knotweed (*Polygonum cuspidatum*), Giant knotweed (*P. sachalinense*), and Himalaya knotweed (*P. polystchyum*). These species of knotweed are native to Asia and are also known as fleeceflower. Oregon has designated these knotweeds as class "B" noxious weeds (ODA 2003) recommending "limited to intensive control at the state or county level as determined on a case-by-case basis." CPRCD proposes to use the herbicide glyphosate (Rodeo® or AquaMaster® or similar formulation) to eradicate known infestations of these knotweeds, and to prevent their further establishment and the associated loss of native riparian vegetation. Knotweed distribution in the watersheds to be treated is relatively restricted at this time. Failure to address the issue in a timely manner will result in an escalation of the problem.

Chemical treatment for knotweed is the most effective control method for established stands due to the plant's extensive root system, which can readily propagate new growth (Dawson and Holland 1999). The use of the herbicide glyphosate has proven effective at controlling knotweed (Beerling 1990, Soll *et al*. 2001). Although Beerling (1990) cautioned that herbicide use was a short-term control measure and not a method of eradication, Dawson and Holland (1999) recommended: (1) Immediately controlling new knotweed colonies before they become well established; (2) containing plant material and treating on site; (3) treating upstream sites and proceed downstream; (4) develop a long-term management policy that includes surveying; and (5) never to consider partial or incomplete control measures.

The BA describes the proposed action, the environmental baseline in the action area, and the potential effects of the action on UWR steelhead and UWR Chinook salmon in the streams where knotweed will be treated in the Willamette River basin. The project description provided in the BA submitted by the BLM is included in this document by reference and is summarized below.

A total of 58.25 acres is proposed for treatment over a 4-year period (2004-2007) in the eleven 5th field watersheds (12 6th field watersheds) listed in Table 1, above. Approximately 17.25 acres would be treated in 2004. According to the BA, most proposed project sites are in rural residential and agricultural areas, and are within the 100-year floodplain of streams. Some knotweed patches exist on exposed gravel bars which are below the ordinary high water elevation in a given stream. Sites vary in size from a few square feet to 1 acre, with the estimated average site encompassing less that 0.25 acre. The 200,000-acre Luckiamute River 5th field watershed has the most known knotweed-infested area with 24 total acres. The 100,000-acre Crabtree Creek 5th field watershed is next with approximately 15 total acres of knotweed-infested area. According to the BA, it is hoped that all knotweed patches in the drainages to be treated in this project will have received an initial treatment within the first 3 years. It is possible that some of the inventoried knotweed patches will not be treated within the 4-year period or that treatments in some watersheds may proceed quicker than expected.

According to the BA, the BLM's preferred treatment method is direct injection of glyphosate into the knotweed stems. Manual control alone has proven labor intensive and ineffective at eradicating knotweed. The stem injection method is only applicable to knotweed stems which are 0.75 inch in diameter or greater. Based on surveys, it is estimated that up to 75% of the knotweed stems on lands to be treated are large enough to be injected. Each stem would be injected with 5 milliliters (or 5 cubic centimeters) of 100% concentration Rodeo® or AquaMaster®. For the injection method, the proposed glyphosate application concentration (100%) would be 648,000 mg/L (or 648,000 ppm). While labor intensive, the injection method has demonstrated excellent efficacy, with no regrowth observed 22 months after injection (Crockett *et al*. 2002). Although more herbicide is used with this application method, there is virtually no chance of the herbicide making direct contact with other plant species or an open water surface. As an alternative to direct injection, a wicking method would be used wherein some knotweed stems will be cut and a 50% solution (324,000 ppm) of herbicide (Rodeo® or AquaMaster®) applied to the cut stems. These treatments will be used beginning in July and extending until the first frost when knotweed drops its leaves, typically in early November. After the first treatment, patches of stem injected or wicked knotweed may require a followup treatment in the second year to kill plants which may have been missed or may not have died from the first treatment. The second year, followup treatments will require significantly lower amounts of herbicide.

Knotweed plants that are too small for injection or wicking (stems less than 0.75 inch in diameter and plants usually less than approximately 4 to 5 feet in height) and that are more than 10 feet from water will be sprayed with Rodeo®, or a similar formulation. The herbicide would be applied using low pressure spray application from either a backpack sprayer with a 4 to 5 gallon capacity, or hand-carried sprayer with a 1 to 2 gallon capacity. Use of low pressure application results in droplet sizes large enough to essentially eliminate drift. Contact with non-target vegetation is limited to small plants growing beneath or within patches of knotweed. When foliar application is used, the herbicide is diluted to 5% or less. The surfactant, LI-700, is proposed for use with the Rodeo®, or a similar formulation, to enhance herbicide adhesion to target plants and increase effective absorption. Foliar spraying will occur from August to early November. Foliar glyphosate treatments have exhibited 95% efficacy at controlling knotweed when applied twice during the growing season or applied once in the fall following cutting to ground level in early summer (Soll *et al*. 2001). According to the BA, most sites will be treated once (July to October), approximately 25% of the sites will be treated twice (once in May/June and once in October), and less than 1 % will be treated three times (late April/May, July, and October. Foliar-sprayed knotweed may require followup treatments in the second and third years to achieve total eradication of a patch.

Although herbicides are considered the only widely effective treatment method, their use may not be possible in some situations because of landowner restrictions. In these limited cases, control will be attempted by root grubbing. Typically, soil will be disturbed up to a depth of 12 inches (no more than 24 inches maximum) over no more than a 20 x 20-foot area. After the knotweed is removed, sites subject to flooding or erosion will be covered with anchored erosion control mats.

Knotweed patches treated through grubbing will require followup treatment over many years until the plants fail to resprout. In these instances, landowners will be asked to commit to long-term followup and retreatment.

The BLM included a list of methods and best management practices in the BA (see pages 13 and 14). These features include, in part:

Project Design Features.

1. Trained individuals will apply herbicides using only stem injection, low pressure spot spray, or direct wicking application methods and in accordance with label instructions.

2. Only glyphosate in the form of Rodeo®, Aquamaster®, or a similar formulation will be used for this project. The herbicide will be used at 100% concentration for the stem injection method. It will be diluted to 50% or less active ingredient when applied directly on fresh stem cuts (direct wicking), and up to 5% when applied to foliage using low pressure application. The surfactant LI-700 will be mixed with the spray for foliar applications.

3. Spray activities will only occur during calm, dry weather conditions to prevent drift and runoff. No spraying will occur during rain or high wind events (*i.e.*, over 5 miles per hour), or if precipitation has been forecasted within 24 hours of spraying.

4. For foliar spray applications, only low pressure sprayers with large droplet nozzles will be used to minimize drift potential.

5. Spray applications will be used only on plants less than 4 to 5 feet tall, and usually smaller.

6. Plants with stems over 0.75 inch in diameter will be treated by direct injection.
7. No herbicides will be applied to open water (surface water) or applied to plants in standing water.

8. Only daily use quantities of herbicides will be transported to the project site.

9. Areas used for mixing herbicides will be placed where an accidental spill will not run into surface waters or result in groundwater contamination. Impervious material will be placed beneath mixing areas to contain any spills associated with mixing/refilling.

10. A spill kit will be on site during all herbicide application (minimum FOSS Spill Tote – Universal or equivalent).

11. Equipment cleaning and storage and disposal of rinsates and containers will follow all applicable state and Federal laws.

12. The vast majority of knotweed patches in the areas proposed for treatment in the Willamette River basin have overland access. Many of the streams along which treatments will occur are too small to float during summer and fall when treatments would occur. However, some sites may only be reached by water travel. Typically, an inflatable kayak will be used, but rubber rafts may occasionally be used. The following measures will be used to prevent a spill during water transport:
    a. No more than 2.5 gallons of glyphosate will be transported per kayak, and typically it will be one gallon or less. If a raft is used, no more than 5 gallons will be transported on the raft. It is estimated that no more than 5 gallons will be transported on any given day.
    b. Glyphosate will be carried in 1 gallon or smaller plastic containers. The containers will be wrapped in plastic bags and then sealed in a dry-bag. The dry-bag will be secured to the watercraft.
    c. Only experienced kayakers/rafters will transport the chemicals.

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

NOAA Fisheries listed UWR steelhead as threatened under the ESA on March 25, 1999 (64 FR 14517) and UWR Chinook salmon as threatened on March 24, 1999 (64 FR 14308). NOAA Fisheries issued protective regulations for each of these evolutionarily significant units (ESUs) under section 4(d) of the ESA on July 10, 2000 (65 FR 42422). Critical habitat is not designated or proposed for these species.

The objective of this Opinion is to determine whether the BLM's proposed knotweed control project on selected non-federal lands in the Willamette River basin for 2004-2007 is likely to jeopardize the continued existence of UWR steelhead or UWR Chinook salmon.

2.1.1 Biological Information

The listing status and biological information for UWR steelhead are described in Busby *et al.* (1996) and NOAA Fisheries (1997). The listing status for UWR Chinook salmon are described in Myers *et al.* (1998).

Table 2 summarizes known usage by ESA listed fish (spawning, rearing, migration) for each 6th field watershed where knotweed treatment would occur. UWR steelhead are known to spawn and rear in portions of Baker, Upper Rickreall, Neal, and Crabtree Creeks, and the Upper Luckiamute River 6th field watershed. UWR steelhead utilize Berry, Glenn, and Silver Creeks as rearing and migration habitat. They are not present in Drift, Brush, Ames, or Salmon Creeks or in the North Fork of the Middle Fork Willamette/Dartmouth Creek or Middle Fork Willamette/Gray Creek drainages. UWR Chinook salmon are known to spawn and rear in portions of Crabtree and Salmon Creeks and in the North Fork of the Middle Fork/Dartmouth Creek and Middle Fork Willamette River. UWR Chinook salmon utilize Glenn and Neal Creeks as rearing and migration habitat. They are not present in Baker, Berry, Upper Rickreall, Drift, Brush, Silver, or Ames Creeks or in the Upper Luckiamute River 6th field watersheds.

Essential features of the adult spawning, juvenile rearing, and adult and juvenile migratory habitats for both species are: Substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food (juvenile only), riparian vegetation, space, and safe passage conditions. The essential features that the proposed project may affect are water quality and riparian vegetation.

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of: (1) Defining the biological requirements of the listed species; and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: (1) Collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize the listed species, it must identify reasonable and prudent alternatives for the action.

NOAA Fisheries also evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitat. NOAA Fisheries must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of the listed species. NOAA Fisheries identifies those effects of the action that impair the function of any essential element of critical habitat. NOAA Fisheries then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NOAA Fisheries concludes that the action will adversely modify critical habitat, it must identify any reasonable and prudent alternatives available.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. Because critical habitat is not designated for UWR steelhead or UWR Chinook salmon, NOAA Fisheries did not include a critical habitat analysis.

Table 2. UWR steelhead and UWR Chinook salmon distribution and habitat use relative to 6th field watersheds where knotweed treatments are proposed

5th Field Watershed	6th Field Watershed	Steelhead Habitat Use	Spring Chinook Salmon Habitat Use
North Yamhill (170900080606)	Baker Creek and Berry Creek (tributary to Baker Creek) (170900080606)	Spawning and rearing in the upper 2.5 miles of Baker Creek; rearing and migration in lower 6.5 miles of Baker Creek Rearing and migration in lower 1.5 miles of Berry Creek	None in Baker or Berry Creeks. Rearing and migration in lower North Yamhill River below Baker Creek confluence
Willamette River/Chehalem Creek (1709000703)	Glenn Creek (170900070302)	Rearing and migration in lower portions of Glenn Creek and Brush College Creek	Rearing and migration in the lower portions of Glenn Creek and Brush Creek
Rickreall Creek (1709000702)	Upper Rickreall Creek (170900070201)	Spawning and rearing in approximately 10 miles of Rickreall Creek and tributaries below Mercer Reservoir	None in Upper Rickreall Creek 6th field watershed
Luckiamute River (1709000306)	Upper Luckiamute River (170900030602)	Spawning and rearing in upper 10 miles of the 6th field and rearing and migration in the lower 3 miles	None in Upper Luckiamute River 6th field watershed
Abiqua Creek (1709000901)	Drift Creek (170900090106) Brush Creek (170900090105)	None in Drift Creek or Brush Creek. Rearing and migration in Silver Creek below Brush Creek	None
Thomas Creek (1709000607)	Neal Creek (170900060704)	Spawning and rearing in the lower 4 miles of Neal Creek	Rearing and migration in the lower 1.5 miles of Neal Creek and in Thomas Creek
Crabtree Creek (1709000606)	Roaring River (170900060602)	Spawning and rearing for 9 miles above Roaring River; rearing and migration below	Spawning and rearing for 9 miles above Roaring River; rearing and migration below Roaring River
Hamilton Creek/South Santiam (1709000608)	Upper South Santiam (Ames Creek) (170900060801)	None in Ames Creek Spawning and rearing in South Santiam	None in Ames Creek Spawning and rearing in South Santiam
Lower North Fork of Middle Fork Willamette (1709000106); Salmon Creek (1709000104); Hills Creek Res. (1709000105)	North Fork of Middle Fork Willamette/Dartmouth Creek (170900010608); Lower Salmon Creek (170900010403); Middle Fork Willamette/Gray Creek (170900010505)	None	Spawning and rearing in North Fork of Middle Fork Willamette, Middle Fork Willamette and Salmon Creek

2.1.3 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species for ESA protection and also considers new data available that is relevant to the determination.

The relevant biological requirements are those necessary for the listed species to survive and recover to naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. Essential habitat features for survival and recovery of UWR steelhead and UWR Chinook salmon include: Substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food (juvenile only), riparian vegetation, space, and safe passage conditions.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful adult and juvenile migration, adult holding, spawning, egg incubation, and rearing. In spite of increased returns in recent years, the status of UWR steelhead and UWR Chinook salmon, based on their risk of extinction, has not significantly improved since the species was listed (WCBRT 2003). This elevated extinction risk is largely reflective of the cyclic nature of oceanic conditions, freshwater habitat conditions that are degraded and not properly functioning, and hatchery practices that threaten the species' ability to survive the natural range of habitat variability.

2.1.4 Environmental Baseline

In step 2 of NOAA Fisheries' analysis, we evaluate the relevance of the environmental baseline in the action area to the species' current status. The environmental baseline is an analysis of the effects of past and ongoing human-caused and natural factors leading to the current status of the species or its habitat and ecosystem within the action area. The action area is defined by NOAA Fisheries regulations (50 CFR 402.02) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of this consultation, the action area includes selected stream reaches on non-federal lands in the 6^{th} field watersheds listed in Table 1 above, where herbicides will be transported, stored, mixed, and applied incidental to the proposed action, extending downstream from each treatment site to the confluence of the Willamette River.

The current population status and trends for UWR steelhead are described in WCBRT (2003) and in Busby (1996) and NOAA Fisheries (1997), and for UWR Chinook salmon WCBRT (2003) and in Myers *et al.* (1998). In general, the current status of UWR steelhead and UWR

Chinook salmon populations is the result of several long-term, human-induced factors (*e.g.* habitat degradation, water diversions, hydropower dams) that serve to exacerbate the adverse effects of natural environmental variability from such factors as drought, floods, and poor ocean conditions.

Due to the knotweed infestations, the project areas contain few natural habitat components and little native vegetation. Knotweed has the ability to spread quickly and out-compete native vegetation communities, which reduces the diversity present in the stream influence zone. Frequently, understory vegetation is absent within knotweed stands due to this domineering growth characteristic. Reducing diversity in the plant community may result in reduction in the diversity of the animal community that depends on that vegetation, including terrestrial and aquatic insects that are consumed by juvenile UWR steelhead and UWR Chinook salmon and other aquatic species that reside in adjacent streams and rivers. Knotweed also has the potential to limit future large wood recruitment to the stream by restricting the establishment of seedlings in the stream influence zone. The suppression of stream-side tree development reduces future cover for juvenile fish and the formation of complex pools that would result from wood recruitment. Knotweed also stabilizes gravel bars in and along the streams, and its removal may temporarily increase bank erosion. Erosion generates turbidity, which may stress juvenile fish and reduce the egg survival when fines are deposited in spawning sites. Stressed fish are more susceptible to disease and predation.

Information about herbicide levels in Willamette River basin streams is limited. However, since pesticides are commonly applied to areas with urban, agricultural, and forestry land uses (Spence *et al*.1996; ODF 2000; Ewing 2000), NOAA Fisheries assumes some localized herbicide contamination of streams in the action area exists.

Most of the streams along which knotweed treatments will occur appear on the Oregon Department of Environmental Quality (ODEQ) 303 (d) List of Water Quality Limited Water Bodies for at least one parameter (ODEQ 2002). Baker, Rickreall, Neal, and Crabtree Creeks and the North Fork of the Middle Fork Willamette River are listed for summer water temperatures. Glenn Creek is listed for dissolved oxygen, and the Luckiamute River is listed for fecal coliform.

Most of the watersheds where knotweed treatments will occur consist mainly (between 83 and 100%) of non-federal lands. The exceptions are the Lower North Fork of the Middle Fork Willamette/Salmon Creek/ Hills Creek Reservoir complex where only 9.6 % of the land is non-federal. Only a very small percentage (0.018% or less) of the non-federal lands in each watershed are proposed for knotweed treatment. Table 3 summarizes land ownership, total acres to be treated, and percent of non-federal land proposed for treatment in each 5th field watershed.

Table 3. Land ownership by 5th field watershed and acres of land to be treated for knotweed control.

5th Field Watershed	Total Acres in Watershed	Non-Federal Acres in Watershed	Percent Non-federal Acres in Watershed	Total Acres to be Treated in Watershed	Percent of Non-federal Acres to be Treated in Watershed
North Yamhill (1709000806)	113,451	100,974	89.0	6	0.006
Willamette/ Chehalem Creek (1709000703)	172,177	172,177	100.0	0.25	0.0001
Rickreall Creek	123,848	119,510	96.5	3	0.003
Luckiamute River (1709000306)	201,507	192,360	95.5	24	0.012
Abiqua Creek (1709000901)	178,383	176,214	98.8	3	0.002
Thomas Creek (1709000607)	92,539	79,245	85.6	5	0.006
Crabtree Creek (1709000606)	99,979	82,385	83.0	15	0.018
Hamilton Creek/ South Santiam (1709000608)	118,099	113,279	95.9	1	0.001
Low.N.Fk.M.Fk .Will./ Salmon Creek/ Hills Creek Res.	351,358	33,769	9.6	1	0.003

Based on the best information available on the current status of UWR steelhead and UWR Chinook salmon, and NOAA Fisheries' assumptions given the information available regarding population status, population trends, and the poor environmental baseline conditions within the action area, the environmental baseline does not meet all of the biological requirements for UWR steelhead or UWR Chinook salmon. Actions that promote or do not retard attainment of properly functioning aquatic conditions, when added to the environmental baseline, are necessary to meet the needs of the species (*i.e.*, survival and recovery of listed fish).

2.1.5 Analysis of Effects

2.1.5.1 Effects of Proposed Action

In step 3 of NOAA Fisheries' analysis, we identify and evaluate the potential effects of the proposed action on the listed species with consideration of the existing environmental baseline in the action area, including whether the proposed action contributes to or maintains a degraded baseline condition.

General Effects

Because of their proximity and connections to streams, ecological conditions and processes in riparian areas strongly influence aquatic habitats. Riparian areas function to: (1) Provide shade, cover, and channel structural elements; (2) supply and process nutrients; (3) support food webs; (4) supply substrate materials; (5) stabilize streambanks; (6) filter upland sediments; and (7) provide linkages to side channels, floodplains, and groundwater (Sullivan *et al*. 1987; Gregory *et al*. 1991; FEMAT 1993; Spence *et al*. 1996).

Most riparian area functions affecting streams and anadromous fish (including bank stability, shade, litterfall, large wood recruitment) occur within a distance equal to the height of a site-potential tree from the edge of the streambank (FEMAT 1993, p. V-27; Spence *et al*. 1996, p. 216-220) for streams without a floodplain, and decline rapidly beyond that distance. Where there is a floodplain, riparian area functions may extend for a distance equal to the height of a site-potential tree from the edge of the floodplain, since during a flood the entire floodplain can function as the stream channel (Rhodes *et al*. 1994). Activities that adversely affect riparian area habitat conditions frequently translate into adverse affects on salmonids in adjacent waterways.

The effects of chemical herbicide use frequently extend beyond the intended target species. Herbicide composition (including inert ingredients, carrier agents, and surfactants), chemical character, environmental conditions, and application techniques are among the parameters that determine the degree to which herbicide effects will impact non-target species and their ecosystems. Scientific studies have documented lethal effects, and to a lesser degree sublethal effects, of herbicide ingredients on many species. These studies are typically laboratory-derived and findings may vary greatly. Conditions in the field may exhibit a greater variability in toxicity (Henry *et al*. 1994) with pre-existing conditions ameliorating effects in some instances and amplifying effects in others. Sublethal affects on fish of herbicide use may include reduced growth, decreased reproductive success, altered behavior, and reduced resistance to stress (Spence *et al*. 1996).

Aquatic biota may be effected by direct exposure to herbicides where they are applied directly to stream channels. Risks of contamination can be reduced if adequate no-spray buffers are maintained (Heady and Child 1994). The risk is further reduced by use of hand application techniques, as opposed to aerial application, and adherence to conservation measures that minimize the risk of drift or exposure resulting from spill events. However, as Spence *et al*.

(1996) state, “toxic levels of chemicals may reach streams from storm runoff and wind drift even when best management practices are employed.”

Indirect exposure vectors may result from surface and subsurface transport. Potential habitat responses include reduction in riparian vegetation, increased aquatic solar radiation, elevated stream temperatures, and reduced prey base. The loss of riparian vegetation may also decrease the amount of organic litter and large wood delivered to streams. Furthermore, bank instability may result from the loss of vegetation root structure, increasing sedimentation and reducing cover for fish.

In addition to effects of active ingredient toxicity, inert ingredient toxicity is frequently overlooked and is often little studied or understood. Similarly, LC_{50} values may not be adequate to predict take in the context of the ESA. By definition, LC_{50} values indicate the concentration at which half of the subject species dies as a result of exposure. Therefore, clearly any concentrations that approach the LC_{50} values can be construed to constitute take. While sublethal effects equally constitute take in terms of the ESA, the concentrations that result in such effects remain imprecise.

Effects of Rodeo® or AquaMaster® Application

The Rodeo® (Dow Agrosciences) and AquaMaster® (Monsanto) formulations are comprised of glyphosate (53.8%) and water (46.2%) as the carrier agent. These two formulations are comparable. Toxicity information presented herein for the Rodeo® formulation also applies to the AquaMaster® formulation.

Glyphosate is a non-selective, broad-spectrum herbicide. Absorbed by leaves and translocated throughout the plant, glyphosate disrupts the photosynthetic process by preventing the synthesis of amino acids required for the construction of proteins. The herbicide affects a wide variety of plants, including grasses and many broadleaf species, and has the potential to eliminate desirable as well as undesirable vegetation. Plant selectivity can be achieved by using injection or wiping application methods. As stated above, the direct injection method is expected to be used on approximately 75% of the knotweed stems to be treated by this project.

Glyphosate is strongly adsorbed by soil and does not retain herbicidal properties following contact with soil. Some information indicates the presence of phosphate ions may impair or reverse glyphosate adsorption (Norris *et al*. 1991). The half-life of glyphosate in soil can range from 3 to 249 days (FS 2000). In general, glyphosate degradation is dependent on soil texture and organic content (FS 2000). Degradation is rapid in soils of low organic content, and slower in soils with high organic content (Tu *et al*. 2001). “Strong adsorption to soil particles slows microbial degradation, allowing glyphosate to persist in soils and aquatic environments” (Tu *et al*. 2001). Adsorption increases with increasing clay and organic content (FS 2000, Tu *et al*. 2001).

The main break-down products of glyphosate are aminomethylphosphonic acid (AMPA) or glycine, which are further broken down by soil microorganisms (Norris *et al*. 1991). One hundred nineteen days after treatment with Rodeo® at 4.7 L ha^{-1}, glyphosate concentrations in the estuarine mudflats of Willapa Bay, Washington, declined 51% to 72%, while AMPA did not degrade during that period (Simenstad *et al*. 1996). No short- or long-term effects to the benthic community were detected.

Glyphosate dissolves easily in water (Norris *et al*. 1991). However, because glyphosate is strongly adsorbed by soil particles, it is not easily released back into water moving through soil. In the project area, glyphosate has the greatest potential to enter flowing water due to direct deposition from drift or accidental spill during application. Indirect contamination may result from over-ground runoff that transports contaminated soil particles to waterways during spring and fall rains, or from inundation of treatment sites in floodplains. Glyphosate entering the water may quickly be bound to sediment and suspended particulates (Solomon and Thompson 2003), although some studies indicate it may remain in freshwater a "long time" (Anton *et al*. 1994). Tests show that the half-life for glyphosate in water ranges from 35 to 63 days. In British Columbia, following application of glyphosate using a no-spray buffer and very low concentrations of glyphosate the breakdown product AMPA were sometimes observed in water and sediments of streams after the first heavy rain following application (FS 2000). These findings were consistent with a study where glyphosate was applied to agricultural watersheds that found the highest concentrations in runoff from 1 to 10 days, and detection up to 4 months, after application (Norris *et al*. 1991). The same study found the maximum amount of herbicide transported by runoff was 1.85% of the applied amount, and that in each of the three study years, the first runoff event after treatment accounted for 99% of the total herbicide runoff. (Norris *et al*. 1991). In over-water applications, higher peak concentrations were always observed in water following heavy rain events up to three weeks after application, and sediment peaks where observed later and persisted in stream sediments for more than one year (FS 2000).

<u>Habitat Effects</u>
By design, use of glyphosate would reduce streambank and floodplain vegetation, including any treated native vegetation. However, use of the stem injection method on an estimated 75% of the knotweed stems to be treated by this project would eliminate the killing of non-target plant species. Elimination of knotweed may result in short-term increases of direct solar radiation reaching adjacent streams and thus contribute to elevated water temperatures. Due to the scattered distribution of the treatment areas, NOAA Fisheries does not expect measurable increases in water temperature resulting from the proposed action. In the long term, the re-establishment of natural vegetation should restore shade and reduce water temperature. The reduction of vegetation on gravel bars should re-establish the natural mobility of these geomorphological features allowing natural transport of bedload sediment to resume. The removal of knotweed from gravel bars could provide a source of spawning gravel and increase the channel cross-sectional area, which may reduce off-site bank erosion and turbidity. The potential increase in suspended sediment generated by increased gravel bar mobility is likely to be a fraction of that produced by the restricted flow capacity of the existing channel in knotweed-infested areas.

<u>Biological Effects</u>
Glyphosate is "moderately to very slightly toxic" to fish (Table 4) (Mensink and Janssen 1994). The Material Safety Data Sheet for Rodeo® indicates the acute LC_{50} for rainbow trout of the 53.8% glyphosate formulation is 60 ppm (Dow 2000). This reflects the toxicity of application methods that do not dilute the formulation (*e.g.*, stem injection, wiping). As stated above, it is expected that 75% of the knotweed stems will be treated by injection of undiluted Rodeo® or AquaMaster®.

Glyphosate sub-lethal effect concentrations for salmonids have not been well studied. Following exposure (14-day) to sub-lethal glyphosate concentrations, a study using carp found histopathological changes in gills and liver structure, as well as in liver, heart, kidney, and serum enzyme activity (Neskovic *et al*. 1996). The threshold gill and liver histopathological responses were observed at concentrations equal to 0.8% (5 ppm) and 1.6% (10 ppm), respectively, of the 96-hour LC_{50} for that species (620 ppm). The gill histopathological response was thought to be reparable if the fish were relocated to uncontaminated water, however, the liver fibrosis could be indicative of serious liver damage. Statistically significant changes in enzyme activity were observed at 0.4% of the 96-hour LC_{50}, the lowest exposure concentration, in liver (alkaline phosphatase, $P<0.01$; and glutamic-pyruvic transaminase, $P<0.05$) and kidneys (glutamic-oxaloacetic transaminase, $P<0.05$; and glutamic-pyruvic transaminase, $P<0.05$). Responses to chemical exposure vary by species, but equivalent exposure concentrations (0.4%, 0.8%, and 1.6% of the 96-hour LC_{50}) for salmonids would be 4.4 ppm, 8.8 ppm, and 17.6 ppm.

Glyphosate exposure (Roundup® formulation) tests with rainbow trout found sac-fry to be the most sensitive life stage followed by emergent fry (Norris *et al*. 1991). Eyed eggs were the most resistant life stage. At a given life stage, there is some suggestion that toxicity does not significantly ($P<0.05$) differ based on specimen size (Mitchell *et al*. 1987). Osmoregulatory function in coho salmon smolt exposed to low concentrations (~50% LC_{50} value) of Roundup® was not found to be affected (Mensink and Janssen 1994, section 9.1.2.3). Although exposure via ingestion has been demonstrated (Henry *et al*. 1994), studies on carp suggest glyphosate has a low potential for bioconcentration (FS 2000).

Rainbow trout fry have been observed to avoid glyphosate (Vision®) at concentrations equal to 50% of the LC_{50} value (Morgan *et al*. 1991). Vision® is a glyphosate salt formulation containing either 10 or 15% surfactant (similar to Roundup®). The same study (Morgan *et al*. 1991) found juvenile rainbow trout did not avoid short-term exposure ($\leq$1 hour) to Vision® until the 96-hour LC_{50} value was exceeded. Therefore, UWR steelhead and UWR Chinook salmon may not avoid exposure to lower glyphosate concentrations by relocating. Sublethal affects on fish have been documented at exposures for various contaminants at concentrations less than 1% of their LC_{50} value.

As stated above, most sites will be treated once with applications occurring from July through October, and will cease at the onset of the first frost. Juvenile UWR steelhead may be present in Baker, Glenn, Upper Rickreall, Neal, and Crabtree Creeks and the Upper Luckiamute River year-round. Juvenile UWR Chinook salmon may be present in Glenn, Neal, Crabtree, and

Salmon Creeks and the North Fork of the Middle Fork Willamette year-round. UWR steelhead spawning peaks in April and early May, with eggs and sac-fry being present in stream gravels until early July. Therefore, adult UWR steelhead would not be present nor would eggs or sac-fry be present in streams during the time when knotweed treatments are proposed. UWR Chinook salmon spawn during late August through September, which means that adults may be present at some locations in Crabtree and Salmon Creeks and the North Fork of the Middle Fork Willamette and the Middle Fork Willamette, and Chinook salmon eggs or fry could be present in the gravels from September through April.

Glyphosate formulations are "moderately to very slightly toxic" to aquatic invertebrates (Mensink and Janssen 1994, section 9.1.2.2). The 96-hour LC_{50} values range from 218 to 1,216 ppm (Henry *et al*. 1994) (Table 4). Exposure may occur by ingestion of contaminated particulates, and increased suspended solids may increase toxicity. Additions of clay increased toxicity to *Daphnia* (Mensink and Janssen 1994). Conversely, toxicity to *Daphnia* was decreased by aeration (Mensink and Janssen 1994). Therefore, glyphosate in well-oxygenated, turbulent streams (*e.g*., headwater streams) with few suspended solids may be less toxic to aquatic invertebrates than slow moving rivers with high levels of suspended solids (*e.g*., lower river reaches). Aeration did not affect toxicity to rainbow trout (Mensink and Janssen 1994, section 9.1..2.3). Mayfly nymphs did not avoid low concentrations (0.2 to 2 ppm) of the Roundup® formulation, however, the nymphs avoided concentrations equal to the 96-hour LC_{50} value (Mensink and Jenssen 1994). Aquatic macroinvertebrate density declined by 42% was for a 1.5 year period following treatment with Roundup® (Spence *et al.* 1996).

Glyphosate toxicity is affected by environmental factors (*e.g*., water hardness, temperature, or pH) (Mitchell *et al*. 1987, Norris *et al*. 1991, Anton *et al*. 1994, Henry *et al*. 1994, Mensink and Janssen 1994, SERA 1997). Toxicity increases at lower pH levels and higher temperatures (Henry *et al*. 1994; Mensink and Janssen 1994, section 9.1.2.3; SERA 1997). With regard to pH, surfactants may have the opposite relationship and exhibit increased toxicity in alkaline waters (SERA 1997, FS 2000).

Surfactants would not be used with the injection or wicking methods. However, the surfactant LI700 would be used in areas where stems are too small for injection, and foliar spray application is used. The aquatic toxicity of surfactants recommended for use with Rodeo® varies greatly, though the toxicity of the proposed surfactant (*i.e.*, LI-700®) is relatively low (Table 4). Surfactants would constitute 1% or less of the applied herbicidal solution. LI-700® (Loveland Industries, Inc.) consists of phosphatidylcholine, propionic acid, and alkylpoloxyethlene ether (80%). The remaining 20% is identified only as "constituents ineffective as adjuvant" (SERA 1997). The additive effect of the surfactant on the toxicity of the applied solution is poorly understood. SERA (1997) reported, "data appear to be inadequate for a quantitative assessment of ecological effects of the surfactant," LI-700®. Glyphosate has been found to have an antagonistic effect on the toxic action of a surfactant (Mensink and Janssen 1994). The actual toxicity of the applied solution is likely between that identified for a 5% Rodeo® solution and the surfactant alone (Mitchell *et al*. 1987). Henry *et al*. (1994) found Rodeo® and the adjuvants X-77 Spreader® and Chem-Trol® were additive in toxicity to amphipods.

The glyphosate formulations (Rodeo® or AquaMaster®) proposed for use under this action, were selected for their low relative toxicity compared to other available formulations. By comparison, the LC_{50} of Roundup® (glyphosate + EntryII® surfactant) to fish is 5 to 26 ppm and the LC_{50} of R-11® (a common surfactant used with glyphosate) to fish is 3.8 ppm (SERA 1997).

Table 4. The Aquatic Toxicity of Glyphosate, Rodeo® or an Equivalent Formulation, and the Proposed Surfactant (LI-700®).
LC_{50}= concentration lethal to 50% the sample population.
EC_{50}= concentration at which 50% of the sample population exhibits an effect.
NOEC = concentration at which no observable effects are noted among the sample population.

	Glyphosate	Rodeo® or equiv.	LI-700®
Salmonid 96-hr NOEC	823 ppm(1)	1,500 ppm(1)	<100 ppm (5)
Salmonid 24-hr LC_{50}		60 ppm(4)	140 ppm (5)
Salmonid 48-hr LC_{50}			130 ppm (5)
Salmonid 96-hr LC_{50}	580 ppm(2)	1,100 ppm(2)	130 ppm (5)
Invertebrate 48-hr NOEC			100 ppm (5)
Invertebrate 48-hr EC_{50}	55 ppm(3)	5,600 ppm(3)	
Invertebrate 24-hr LC_{50}			450 ppm (5)
Invertebrate 48-hr LC_{50}	117 - 930 ppm(3)	218 -1,216 ppm(3)	170 ppm (5)
Invertebrate 96-hr LC_{50}		720- 1,177 ppm(3)	190 ppm (6)

(1) Anton et al.
(2) Mitchell *et al*. 1987.
(3) Henry *et al*. 1994.
(4) Dow 2000.
(5) Loveland Industries, Inc. 2000.
(6) FS 2000.

Vectors of Exposure

The injection method, proposed for use on 75% of the knotweed stems on areas to be treated by this project, would avoid direct contamination from drift or indirect contamination from runoff since the herbicide would remain contained either in the applicator or the plant itself and no soil contamination would result. However, the injection method might increase the spill risk since concentrated Rodeo® (or AquaMaster®) would be used and more time on site would be required. A spill event could result in localized and short-term effects. Due to their limited mobility, sac-fry and emergent fry would be at the greatest risk of extended exposure to lethal effect concentrations of glyphosate. NOAA Fisheries expects that the best management practices

(BMPs) and project design features (see section 1.2 above) to be implemented for this project will minimize the potential for a spill to occur.

The proposed application concentrations (32,400 ppm for foliar application, 324,000 ppm for wicking, and 648,000 ppm for direct stem injection) exceed the known effect concentrations (Table 4) and therefore direct contamination may cause an affect on fish or invertebrates present in proximity to a stream entry point. The effect will largely be dependent on the degree and extent of contamination and the ability or inclination of the organism to avoid exposure. The temporal and spatial extent of exposure would depend on the mixing zone needed to reduce contamination levels below the effect threshold concentration.

Mixing zone size would vary greatly and depend on the contamination volume (*e.g*., drift or spill), the receiving volume (*e.g*., 1 cfs or 30 cfs), the point of entry (*e.g*., drift deposition, gravel bar inundation), and the amount of turbulence (*e.g*., step-pool, slack water side channel), but are expected to be limited in size due to the turbulent character of headwater stream reaches and the volume of receiving waters (*e.g.* South Santiam River, Crabtree Creek) in lowland reaches. Hydrologically complex waterways with meanders, pools, riffles, and eddies that accelerate mixing and dilution are more likely to disperse contaminants than simplified waterways with consistent channel velocities that allow contaminants to maintain a more consolidated profile (Lee 1995, Heard *et al*. 2001). Mixing distances are shorter in smaller streams and mixing is slower when the discharge point is near the streambank (Heard *et al*. 2001). A recent study of transverse mixing distances in small streams (1.4 to 3.5 $ft^3 s^{-1}$) in eastern Iowa found heterogeneity in tracer concentrations 16.4 feet to more than 328 feet downstream of mid-channel release points (Heard *et al*. 2001). Unfortunately, short of empirically determining mixing distances for specific stream reaches, the ability to predict mixing lengths quantitatively is not yet feasible (Heard *et al*. 2001).

Potential input locations would be distributed over 40 miles of streams in eleven different 5th field watersheds (twelve 6th field watersheds) at selected locations where knotweed patches occur, and exposure concentrations are expected to be well below lethal response thresholds. Because treatment of most of the areas of knotweed infestation is expected to be completed during 2004 and 2005, the greatest risk of surface water contamination and aquatic effects is expected to occur during those years. According to the BA, some knotweed patches occur on exposed gravel bars which are below the ordinary high water elevation in a given stream. If foliar application is used on these patches, there is an increased risk of spray drifting over surface waters or entering the water by interstitial flow through the gravel. There is also the slight possibility that water could cover the gravel bar during a freshet.

The BLM completed "worst case scenario" analyses of a runoff event (rain storm) (BA pages 17-19), and estimated potential endpoint concentrations of glyphosate and surfactant contamination in streams at several orders of magnitude below salmonid or invertebrate effect concentrations. The calculated "worst case scenario" concentration for glyphosate was 0.0019 mg/L (1ppm equals 1 mg/L) which is well below the 96-hr LC50 for salmonids shown in Table 4, above. Further, it is highly unlikely that aquatic organisms would be exposed to the calculated concentration of glyphosate for a 96-hour period; more likely the exposure would be for 1 hour or less. Once the glyphosate entered the water, the concentration would be quickly reduced by dissipation in the flowing water.

Any contamination of flowing water is expected to move downstream and decline rapidly as mixing occurs and glyphosate binds to particulates (Solomon and Thompson 2003), although elevated concentrations may persist near bank areas, eddies, and side channels with slower velocities. The preponderance of evidence suggested by the literature indicates that the use of glyphosate near the water poses a minimal risk of long-term adverse affects on salmonids or their prey base (Morgan *et al*. 1991, Norris *et al*. 1991, Anton *et al*. 1994, Gardner and Grue 1996, Simenstad *et al*. 1996, FS 2000, Kilbride and Paveglio 2001). Any affects to freshwater invertebrates would likely be of limited temporal and spatial extent as well. Therefore, any contamination would represent short-term, non-lethal exposure for UWR steelhead and UWR Chinook salmon, and would not significantly reduce their prey base. To some extent, this finding is based on the assumption that existing background chemical contamination is minimal and not of such character as to cause a synergistic or threshold effect to occur.

2.1.5.2 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." This is step 4 in NOAA Fisheries' analysis process. As stated above, most of the watersheds where knotweed treatments will occur contain a high percentage of private land (Table 3). Land use on these non-federal lands include timber production, agriculture, and rural and urban development. Chemical fertilizers or pesticides are used on many of these private lands for other purposes, but no specific information is available regarding their degree of use within the project area. Furthermore, NOAA Fisheries does not consider the rules governing these land uses on these non-federal lands within Oregon to be sufficiently protective of watershed, riparian, and stream habitat functions to support the survival and recovery of listed species. Therefore, these habitat functions likely are at risk due to future activities on non-federal lands within the basin. NOAA Fisheries is not aware of any other specific future non-federal activities within the action area that would cause greater impacts to listed species or their habitat than presently occurs.

2.1.6 Conclusion

After reviewing the best available scientific and commercial information available regarding the status of the UWR steelhead and UWR Chinook salmon ESUs considered in this Opinion, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NOAA Fisheries opinion that the action, as proposed, is not likely to jeopardize the continued existence of these species.

Our conclusion is based on the following considerations: (1) Low toxicity herbicides (Rodeo® or AquaMaster®) and the surfactant (LI-700®) are proposed for use in areas that may allow aquatic contamination to occur; (2) water is the only carrier agent used in Rodeo® or AquaMaster®; (3) glyphosate binds strongly with soils which minimizes the potential for runoff to transport herbicide to streams; (4) herbicide application will not occur in or over water; (5) prey base effects are expected to be spatially and temporally limited, (6) it is estimated that 75% of the knotweed patches would be treated once, 25% may need to be treated twice and 1% three times, thus limiting the potential for multiple exposures of listed fish to the herbicide; (7) repeat applications of glyphosate have not been found to cause long-term adverse affects; (8) an estimated 75% of the knotweed will be treated by direct injection of the herbicide into the plant stems, thus eliminating the potential for drift or runoff; (9) wind limits during foliar applications will minimize the risk of direct contamination of waterways; (10) no application will occur when precipitation is forecast within 24 hours to minimize the risk of indirect water contamination via ground transport; (11) staging areas will be in areas that will not contaminate surface or ground water, (12) herbicide use to control knotweed will be significantly reduced after 2 years; (13) aggressive knotweed control now will reduce long-term need for herbicide use in riparian areas in these watersheds by reducing the potential for future knotweed infestations, and (14) less than 0.02% of non-federal lands in each of the 5th field watersheds, where treatments will occur, are proposed to be treated for knotweed control.

2.1.7 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species or to develop additional information.

The following conservation recommendations are consistent with these obligations, and therefore should be implemented by the BLM:

1. To minimize the amount of chemical herbicides used beside streams, the BLM should work to develop effective non-chemical treatments to control invasive plants.

2. To minimize the use of chemical herbicides in the future, the BLM should develop a watershed-based prevention and control strategy for invasive plants in cooperation with non-federal land owners, and particular consideration for Dawson and Holland's (1999) recommendations for invasive plant control.

For NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed species or their habitat, NOAA Fisheries requests notification of the implementation of any conservation recommendation.

2.1.8 Reinitiation of Consultation

Consultation must be reinitiated if: (1) The amount or extent of taking specified in the incidental take statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

Additionally, if the BLM fails to provide the specified annual monitoring information by the required date (see section 2.2.3, term and condition #3), NOAA Fisheries will consider that a modification of the action that causes an effect on listed species not previously considered and causes the incidental take statement of the Opinion to lapse.

To reinitiate consultation, the BLM must contact the Habitat Conservation Division (Oregon Habitat Branch) of NOAA Fisheries at 525 NE Oregon Street, Suite 500, Portland, Oregon 97232-2778, and refer to NOAA Fisheries No.: **2004/00650**.

2.2 Incidental Take Statement

The ESA at section 9 [16 USC 1538] prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule [50 CFR 223.203]. Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." [16 USC 1532(19)] Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." [50 CFR 222.102] Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." [50 CFR 17.3] Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." [50 CFR 402.02] The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement [16 USC 1536].

An incidental take statement specifies the effect of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize adverse effects and sets forth terms and conditions with which the action agency must comply to implement the reasonable and prudent measures.

2.2.1 Amount or Extent of the Take

NOAA Fisheries anticipates that the action covered by this Opinion is reasonably certain to result in incidental take of UWR steelhead and UWR Chinook salmon from contamination of streams with Rodeo® or AquaMaster® herbicide and the surfactant LI-700®. The effect of actions such as this are largely unquantifiable because take is in the form of harm, which includes habitat modification. Therefore, even though NOAA Fisheries expects some low level of incidental take to occur due to the actions covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NOAA Fisheries to estimate a specific amount of incidental take to the species. Based on the information in the BA, NOAA Fisheries anticipates that an unquantifiable amount of incidental take could occur as a result of actions covered by this Opinion. In instances such as these, NOAA Fisheries designates the expected level of take in terms of the extent of take. For the proposed action, the extent of take is limited to harm within the action area resulting from the use of Rodeo®, AquaMaster®, and LI-700® in the manner proposed by the BLM, including project design features limiting the formula, rate of application, and total volume of application and specific areas to be treated. Take that occurs from actions that do not follow the project design features or that extends beyond the action area is not authorized by this Opinion.

2.2.2 Reasonable and Prudent Measures

NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to avoid or minimize take of UWR steelhead and UWR Chinook salmon resulting from implementation of this Opinion.

1. Minimize incidental take from the proposed activity by following the proposed project design features described in the BA.

2. Minimize incidental take associated with herbicide application by implementing additional time, place, and type of application use restrictions on the use of glyphosate to minimize contamination of streams.

3. Complete an annual report for 4 years to ensure this Opinion is meeting its objective of minimizing the likelihood of take from the proposed activity and provide the report to the Oregon Branch of NOAA Fisheries.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the BLM must ensure CPRCD compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. Implementation of the terms and conditions within this Opinion will further reduce the risk of adverse effects to UWR steelhead and UWR Chinook salmon. These terms and conditions are non-discretionary.

1. To implement reasonable and prudent measure #1 (project design features), the BLM shall ensure that all project design features provided in the BA (BA, pages 13 and 14; repeated in this Opinion in section 1.2) are followed.

2. To implement reasonable and prudent measure #2 (additional use restrictions), the BLM shall ensure that:

   a. In stream reaches where foliar application of glyphosate (Rodeo® or AquaMaster® or similar formulation) is used to treat knotweed growing in dry portions of the stream channel below the ordinary high water elevation, application is limited to the preferred in-water work period for each watershed. The preferred period for the Middle Fork Willamette River/Lookout Point, Lower North Fork of the Middle Fork Willamette River, Salmon Creek, and Hills Creek Reservoir watersheds is July 1 to August 15. For Glenn and Rickreall Creeks and the Upper Luckiamute the period is July 1 to September 30. For Baker and Berry Creeks, it is July 1 to October 15; and, for Crabtree and Neal Creeks it is July 15 to August 31.
   b. No herbicides, surfactants, or other adjuvants other than those identified in the proposed action are applied.
   c. The contracted applicator is aware of the provisions of this Opinion before commencing herbicide application operations.
   d. The contracted applicator has a spill response plan and is familiar with use of the spill kit before commencing herbicide application operations.
   e. All chemical storage, chemical mixing, and post-application equipment cleaning is completed in a confined area to prevent the potential contamination of any riparian area, perennial or intermittent waterway, ephemeral waterway, or wetland.
   f. Erosion control measures (*e.g.*, silt fence, native grass seeding) are used where de-vegetation may result in the significant delivery of sediment to UWR steelhead or UWR Chinook salmon habitat.

3. To implement reasonable and prudent measure #3 (annual monitoring and reporting requirements) the BLM shall ensure:

   a. An annual report of herbicide treatments to control knotweed on non-federal lands in each of the 5^{th} field watershed where knotweed treatments are implemented is submitted to NOAA Fisheries. The report will cover the herbicide application period (May 1 to November 15) for the calendar year and is due December 31 of that year. The purpose of the reporting is to help estimate the extent and amount of take that may have occurred and validate assumptions regarding watershed effects. Each annual report shall contain an application record and watershed summary.
      i. The herbicide application record shall contain, at a minimum, the following information by watershed. Appendix A of this Opinion contains

an example recording form, but any organized format may be used to present the information.

(1) Date of application.

(2) Site treated.

(3) Treatment method (direct injection, wicking, foliar application).

(4) Quantity of herbicide used, including concentration, the application rate, and total volume applied.

(5) Weather conditions (*e.g.*, wind, precipitation) during application periods and notation of any precipitation occurring within a 24-hour period following treatment.

ii. The watershed summary shall provide, at a minimum, the total acreage treated and the total herbicide applied by 5^{th} field watershed. *Appendix B* contains an example watershed summary form, but any organized format may be used to present the information.

b. Send the annual report to NOAA Fisheries at:

NOAA Fisheries
Oregon State Habitat Office
Attn: 2004/00650
525 NE Oregon Street, Suite 500
Portland, OR 97232

If the BLM fails to provide the specified annual monitoring reports by January 31 of the following year, NOAA Fisheries may consider that a modification of the action that causes an effect on listed species not previously considered and causes the incidental take statement of this Opinion to lapse. Exceptions must receive NOAA Fisheries' agreement in writing before the due date.

c. Salvage notice. If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify the Vancouver Field Office of NOAA Fisheries Law Enforcement at 360.418.4246. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.

d. This programmatic incidental take statement shall expire on December 31, 2007.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50CFR600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;

- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;

- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NOAA Fisheries, the Federal agency shall explain its reason for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of its location.

3.2 Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for three species of Pacific salmon: Chinook (*Oncorhynchus tshawytscha*); coho (*O. kisutch*); and Puget Sound pink salmon (*O. gorbuscha*) (PFMC 1999). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the *Pacific Coast Salmon Plan* (PFMC 1999). Assessment of potential adverse effects to these species' EFH from the proposed action is based on this information.

3.3 Proposed Action

The proposed action is detailed above in section 1.2 of this document. The action area includes tributary streams within the Willamette River basin which have been designated as EFH for various life stages of Chinook salmon and coho salmon. These are Baker, Berry, Glenn, Rickreall, Drift, Brush, Neal, Crabtree, and Ames Creeks and the Luckiamute River. The North Fork of the Middle Fork Willamette, Salmon Creek, and Hills Creek Reservoir watersheds are not designated as EFH for Chinook salmon and coho salmon because they are upstream from Dexter Dam on the Middle Fork Willamette River.

3.4 Effects of Proposed Action

As described in detail in the ESA portion of this consultation, the proposed activities would result in detrimental, short-term, adverse effects to a variety of habitat parameters.

3.5 Conclusion

NOAA Fisheries believes that the proposed action may adversely affect the EFH for coho salmon and Chinook salmon.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations for any Federal or state agency action that would adversely affect EFH. In addition to conservation measures proposed for the project by the BLM, all of the terms and conditions contained in section 2.2.3 of the ESA portion of this Opinion are applicable to salmon EFH, except those in the salvage of specimens of listed species. Therefore, NOAA Fisheries incorporates each of those measures here as EFH conservation recommendations.

3.7 Statutory Response Requirement

The MSA (section 305(b)) and 50 CFR 600.920(j) requires the BLM to provide a written response to NOAA Fisheries' EFH conservation recommendations within 30 days of its receipt of this letter. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. If the response is inconsistent with NOAA Fisheries' conservation recommendations, the BLM shall explain its reasons for not following the recommendations.

3.8 Supplemental Consultation

The BLM must reinitiate EFH consultation with NOAA Fisheries if either the action is substantially revised or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

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APPENDIX A

Annual Site Record Example

Salem BLM District
Knotweed Eradication Project - Annual Site Record

Year: _____________

Watershed: ______________________________ Sheet _______ of _______

Date	Site	Formulation Applied					TreatmentArea (acres)	Weather	Rain ≤24 hr
		Herbicide			Adjuvant				
		Name	%	Quantity	Name	%			
	Example 1	Rodeo®	5%	2.1 gal	LI-700	0.5%	1.5	2 mph wind, dry	none
	Example 2	Rodeo®	100%	0.1 gal	none	n/a	0.1	n/a, injection	n/a
	Example 3	Rodeo®	50%	0.2 gal	none	n/a	0.2	n/a, wicking	n/a

APPENDIX B

Annual Watershed Summary Example